

A TOOL GUIDE ARRANGEMENT

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Inventor: KLINTBERG NICLAS (SE)

Applicant: KLINTBERG NICLAS (SE)

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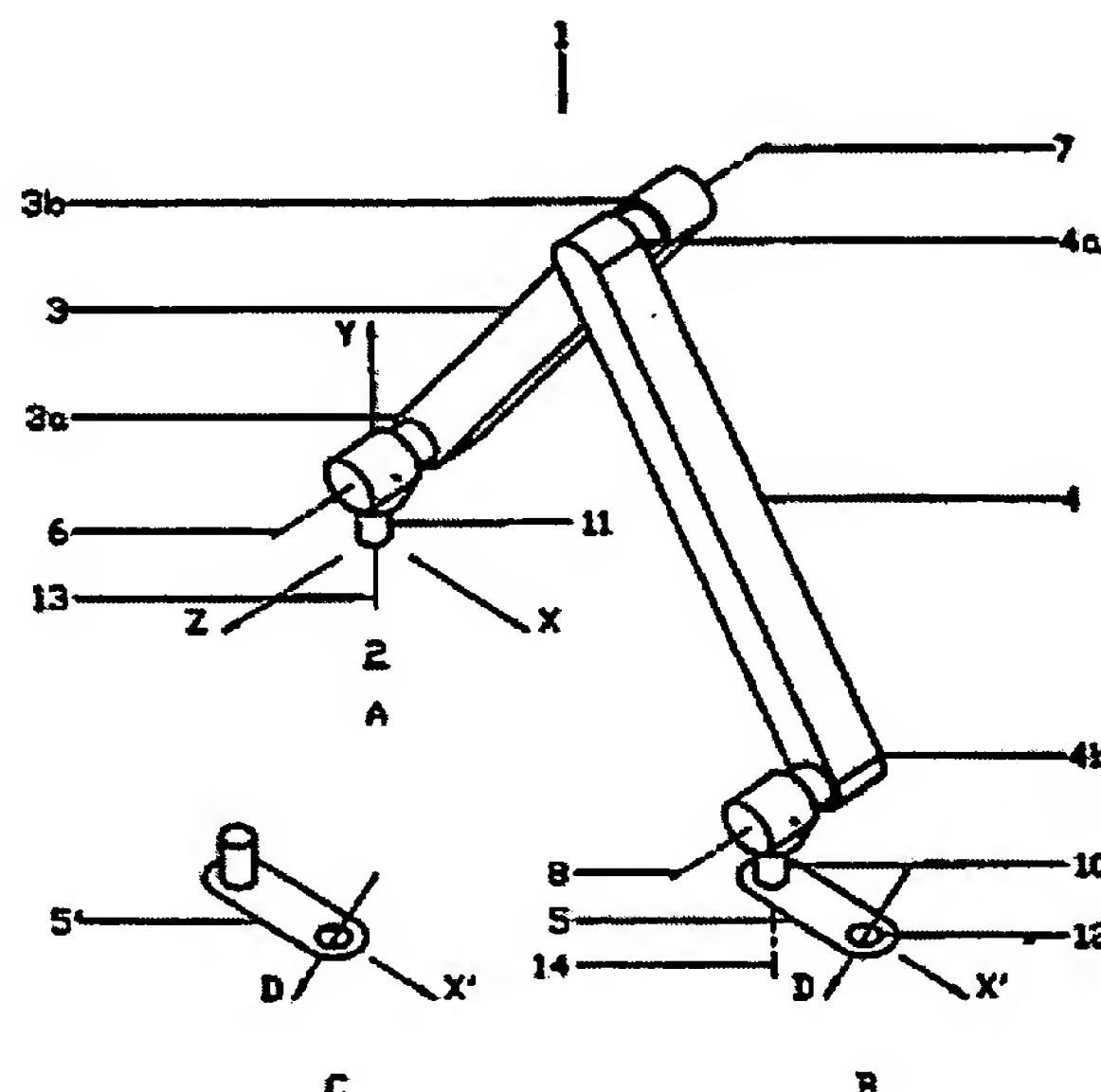


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Abstract of WO9011165

The invention relates to an arrangement by means of which a tool or the like can be guided to different positions belonging to a first plane (A), the arrangement including a support (2), a first arm (3), a second arm and a tool-attachment (5) adapted to the tool, where one end (3a) of the first arm is pivotally connected to the support via a first pivot axle (6), one end (4a) of the second arm is pivotally connected to the other end (3b) of the first arm via a second pivot axle (7), whereas the other end (4b) of the second arm is pivotally connected to the tool-attachment (5) via a third pivot axle, and in which arrangement endless belts or the like are arranged to pass over guide rollers co-acting with respective pivot axles in a manner such that when the tool-attachment is moved along a line (x-line) projected from the arms towards the plane, the tool-attachment (5) will take one and the same orientation. This arm (3) is pivotally mounted relative to a baseplate (12) via a fourth pivot axle (13), which forms a right angle with the first pivot axle (6), whereas the tool-attachment (5) is arranged to pivot relative to a fifth pivot axle (14), which forms a right angle with the third pivot axle (8), to a corresponding degree in an opposite direction.



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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/SE90/00183</p> <p>(22) International Filing Date: 21 March 1990 (21.03.90)</p> <p>(30) Priority data: 8901019-3 22 March 1989 (22.03.89) SE</p> <p>(71)(72) Applicant and Inventor: KLINTBERG, Niclas [SE/SE]; Klotvägen 14, S-151 59 Södertälje (SE).</p> <p>(74) Agent: LINDBLOM, Erik, J.; Skördevägen 88, S-122 35 Enskede (SE).</p> <p>(81) Designated States: AT (European patent), BE (European + patent), CA, CH (European patent), DE (European pa- tent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European pa- tent), SE (European patent), SU, US.</p>		<p>Published <i>With international search report.</i></p>
<p>(54) Title: A TOOL GUIDE ARRANGEMENT</p> <div> </div> <p>(57) Abstract</p> <p>The invention relates to an arrangement by means of which a tool or the like can be guided to different positions belonging to a first plane (A), the arrangement including a support (2), a first arm (3), a second arm and a tool-attachment (5) adapted to the tool, where one end (3a) of the first arm is pivotally connected to the support via a first pivot axle (6), one end (4a) of the second arm is pivotally connected to the other end (3b) of the first arm via a second pivot axle (7), whereas the other end (4b) of the second arm is pivotally connected to the tool-attachment (5) via a third pivot axle, and in which arrangement endless belts or the like are arranged to pass over guide rollers co-acting with respective pivot axles in a manner such that when the tool-attachment is moved along a line (x-line) projected from the arms towards the plane, the tool-attachment (5) will take one and the same orientation. This arm (3) is pivotally mounted relative to a baseplate (12) via a fourth pivot axle (13), which forms a right angle with the first pivot axle (6), whereas the tool-attachment (5) is arranged to pivot relative to a fifth pivot axle (14), which forms a right angle with the third pivot axle (8), to a corresponding degree in an opposite direction.</p>		

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TITLE OF THE INVENTION: A tool guide arrangement

TECHNICAL FIELD

5 The present invention relates to an arrangement by means of which a tool or like device can be guided into different two-coordinate positions belonging to a first plane.

10 The invention also relates to arrangements such as those which include a support, a first arm, a second arm and a tool-attachment adapted to the tool.

The present invention is therewith based on an arrange-
15 ment in which one end of said first arm is pivotally connected to the support via a first, preferably horizontal pivot axle, one end of said second arm is pivotally connected to the other end of said first arm via second horizontal pivot axle, whereas the other end of
20 said second arm is pivotally connected to said tool attachment via a third horizontal pivot axle, and in which an endless belt or the like is arranged to extend over guide rollers co-acting with respective pivot axles in a manner such that when the tool-attachment
25 and the tool are moved along a line projected from said arms onto the first plane, the tool-attachment and the tool will take one and the same orientation.

It will be understood that the inventive principle can
30 also be applied with the aforesaid "horizontal" pivot axles deviating from the horizontal.

It is therefore important for the purpose of applying the invention in practice and for interpreting the
35 following Claims that such terms as "horizontal" and

"vertical" shall only be interpreted as references and that these terms can signify other orientations than those defined, without departing from that which is peculiar to the invention.

5

BACKGROUND PRIOR ART

An arrangement of the aforescribed kind can be considered to be known from what is described and illustrated in the US Patent Specification 4,299,533, which illustrates a manipulator which is intended for moving material to one of several different locations along a line projected from the arms onto the first plane.

15 In this instance, movement is effected in a straight line along a plane to one of several available positions on the line.

The European Patent Application 0 076 947 teaches a device, a so-called robot, which is intended for moving an object and in which the movement path and the position may be any selected path and position within a hemisphere contingent on the length of one arm, this being effected by pivotally connecting a single robot arm or two mutually-coupled arms to a support.

20 A similar arrangement can be considered to be previously known from the US Patent Specification 4 398 863, which also describes the possibility of pivoting an arm about support.

30

Finally, DE-A1-3 308 474 teaches a robot system comprising an arrangement which is pivotal about a first vertical axle.

The present invention can be considered a further development of the subject matter of the last mentioned publication.

5 SUMMARY OF THE INVENTION

TECHNICAL PROBLEMS

10 When considering the present standpoint of techniques,
as described in the foregoing, it will be seen that a
qualified technical problem, particularly with respect
to the application mentioned in the introduction, is
one of providing conditions, with the aid of simple
means, such that the tool-attachment and the tool will
15 obtain one and the same orientation irrespective of the
manner in which one end of the first arm is caused to
rotate in relation to a baseplate.

20 It will also be seen that a technical problem is one of
being able to employ such measures, with the aid of
simple means, that when the arm is rotatably arranged
relative to a baseplate in a first direction, the tool-
attachment will rotate to a corresponding degree in an
opposite direction.

25 It will also be seen that a technical problem is one of
providing circumstances such that a tool fixedly moun-
ted in the tool-attachment and positioned obliquely in
relation thereto will maintain its oblique setting
30 irrespective of the position of the tool-attachment.

It will also be seen that a technical problem is one of
providing, in connection with a vertical pivot axle, a
separate gear-wheel arrangement comprising three

mutually co-acting gears having predetermined relationships between pivotal directions, so as thereby to create conditions for activating the tool-attachment in the aforesaid manner also in a horizontal plane in response to movement of the arm in said horizontal plane.

It will also be seen that a technical problem is one of providing simple means for rotating the tool-attachment in the aforesaid manner, with the aid of guide rollers and endless belts operative to transmit movement generated from a second and a third gear to an output axle adjacent the tool-attachment.

It will also be seen that a qualified technical problem is one of realizing the significance of allowing the direction for a vertical pivot axle for a sixth gear wheel to be positioned in parallel with a vertical pivot axle of a first gear wheel.

When using pairs of parallel endless belts, it will be seen that a technical problem is one of enabling pairs of guide rollers to readily co-act with one another such as to drive two pairs of endless belts in mutually opposite directions and thereby reduce the effect of lateral forces in operation.

According to the invention, a first, second and third pivot axles shall be orientated horizontally, whereas fourth and fifth pivot axles shall be vertically orientated, in order to afford a simple function of the arrangement thereby.

Finally, it will also be seen that a technical problem is one of realizing that an arrangement successful in

5 solving one or more of the aforesaid technical problems and which offers an alternative use is one in which a first gear can be driven by a motor and in which said driving of said endless belt is transmitted as rotational movement to a sixth gear and its axle and that a cutting or grinding tool can be attached directly to said sixth gear and its axle.

SOLUTION

10

The present invention affords a solution to one or more of the aforesaid technical problems and is based on an arrangement configured to enable a tool or the like to be guided to different positions which belong to a first plane. To this end, the arrangement includes a support, a first arm, a second arm, and a tool-attachment adapted for said tool, where one end of the first arm is pivotally attached to the support via a first horizontal pivot axle, one end of said second arm is pivotally attached to the other end of said first arm via a second horizontal pivot axle, whereas the other end of said second arm is pivotally attached to the tool-attachment via a third horizontal pivot axle. Endless belts or the like are intended to pass over guide rollers co-acting with respective horizontal pivot axles in a manner such that when the tool-attachment moves along a line projected from the arms onto said plane, the tool-attachment will take one and the same orientation.

30

In accordance with the present invention, it is proposed that the arm included in said arrangement is pivotally mounted in relation to a baseplate via a fourth vertical pivot axle which forms a right angle with said first horizontal pivot axle; and in that the

35

tool-attachment is arranged to rotate relative to a fifth pivot axle which forms a right angle with said third horizontal pivot axle, to a corresponding degree and in an opposite direction.

5

As proposed embodiments, which fall within the scope of the inventive concept, it is proposed that a fifth pivot axle is vertically positioned and carries a first gear wheel which, when the tool-attachment is moved and pivoted in a first direction, is operative to drive a second gear wheel in one direction and a third gear wheel in the opposite direction.

10

It is also proposed that each said second and said third gear wheel is caused to co-act with a respective guide roller, a first and a second guide roller, each of which co-acts via a respective endless belt with a respective third and fourth guide roller related to said second horizontal pivot axle, which axle is connected to fifth and sixth guide rollers and related to said second pivot axle, and in that the fifth and sixth guide rollers, each via a respective endless belt, co-act with seven and eight guide rollers co-acting with fourth and fifth gear wheels which are in engagement with a sixth gear wheel.

15

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30

The direction of the fifth pivot axle and the pivot axle of the first gear wheel shall be positioned in parallel with the pivot axle of the sixth gear wheel.

The third and fifth guide rollers are orientated adjacent one another and joined together.

35

Each of the endless belts comprises a lag-free movement transmission, such as a toothed belt and each of the

guide rollers has a peripheral surface provided with recesses corresponding to the projections on said belt.

5 It is also proposed that the first, second and third pivot axles are parallel and horizontally orientated, whereas the fourth and fifth pivot axles are parallel and vertically orientated.

10 Finally, the possibility is afforded of allowing the first gear wheel to be driven by a motor and of transmitting this drive, via said endless belt, as a rotary movement to the sixth gear wheel and its axle. In this respect, the sixth gear wheel and its axle can be connected directly via a spindle to a cutting or
15 grinding tool.

ADVANTAGES

20 Those advantages primarily afforded by an arrangement according to the present invention reside in the possibility of moving selectively a tool-attachment, adapted to a tool, along a plane while maintaining a predetermined orientation of the tool-attachment and within a radius determined by the total length of two
25 arms. Because the tool-attachment is secured in the described manner, a tool fitted in said attachment will constantly take a position and alignment contingent on said attachment.

30 At the same time as it is found possible, with the aid of a motor on one end of a first arm, to impart to a pin co-acting with the tool-attachment a corresponding rotational speed and therewith enable a grinding or cutting tool to be mounted directly onto said axle.

35

5 The primary characteristic features of an arrangement which will enable a tool or the like to be guided to different positions in a first plane in accordance with the invention are set forth in the characterizing clause of the following Claim 1.

10

BRIEF DESCRIPTION OF THE DRAWINGS

15 An embodiment at present preferred and having features significant to the present invention will now be described in more detail with reference to the accompanying drawings, in which

20 Figure 1 is a simplified, perspective view of an arrangement with the tool-attachment in a first position, and also illustrates the orientation of the tool-attachment when said attachment is moved by the arms to an illustrated position located on one side of a line projected from the arms onto the plane;

25 Figure 2 is a side view which illustrates the operation of the arrangement in a highly simplified fashion; and

Figure 3 illustrates the arrangement of Figure 2 in horizontal projection.

30

DESCRIPTION OF EMBODIMENTS AT PRESENT PREFERRED

35 Figure 1 is a simplified illustration of an arrangement by means of which a tool or the like can be guided to different positions pertinent to a first plane "A",

defined by "x" and "z"-coordinates, said arrangement 1 including a support 2, a first arm 3, a second arm 4, and a tool-attachment 5 adapted to the tool concerned.

5 One end 3a of the first arm 3 is pivotally connected to the support 2 via a first horizontal pivot axle 6, one end 4a of the second arm 4 is pivotally connected to the other end 3b of the first arm via a second horizontal pivot axle 7, whereas the other end 4b of said
10 second arm 4 is pivotally connected to the tool-attachment 5 via a third horizontal pivot axle 8, and endless belts or the like are arranged to pass over guide rollers co-acting with respective pivot axles such that when the tool-attachment 5 is moved along a
15 line "x" projected from the arms 3, 4 onto the plane "A", the tool-attachment 5 will take one and the same orientation.

In Figure 1, the "compass direction" for the tool-attachment 5 has been identified by the reference sign
20 "x'".

It should be noted here that the tool-attachment 5 co-acts with a vertical axle 10 and that one end 3a of the
25 arm 3 co-acts with the support 2 via a vertical axle 11.

The tool-attachment 5 is provided with a symbolic recess 12 intended to function as a tool holder, e.g. a
30 drilling machine, in which case the tool-attachment 5 shall then take a position above the plane "A".

The tool-attachment 5 and its hole 12 can also be considered to represent marking equipment intended for
35 marking predetermined positions in the plane "A" (x-z-

plane) or any other plane.

It should be noted that a tool secured to the attachment 5 can be allotted any desired direction "D". This direction will be the same, irrespective of the position of the attachment 5 along the plane "A".

As will be seen from Figures 2 and 3, the arm 3 is pivotally mounted in relation to a baseplate 12 around a fourth vertical pivot axle 13 which forms a right angle with the first pivot axle 6.

The tool-attachment 5 is arranged to rotate relative to a fifth vertical pivot axle 14 forming a right angle with the third pivot axle 8, to a corresponding degree and in an opposite direction.

If it is assumed that the tool-attachment 5 is connected to the axle 10 and that the tool-attachment is moved to the position 5' illustrated in Figure 1, with the aid of the arms 3, 4, the pivot axle 6 will be rotated by the arms 3, 4 in relation to the pivot axle 13 in the manner illustrated by the arrow "P1", thereby meaning that respective endless belts 20, 21, 22, 23 will move in the arrowed directions, which in turn means that the tool-attachment 5 will be moved to the right in Figure 1 towards the position 5' with subsequent rotation in the direction of the arrow "P2" and therewith orientation of the tool-attachment will be one and the same (X') during the whole of the movement from the position "B" to the position "C" in Figure 1.

The fourth pivot axle 13 extends vertically and carries a first gear wheel 30 which, when the tool-attachment 5 is displaced and rotated in a first direction, say from

position "B" to position "C" in Figure 1, is operative to drive a second gear wheel 31 in one direction and a third gear wheel 32 in an opposite direction.

5 Each of the second 31 and the third 32 gear wheel co-acts with a respective guide roller, a first guide roller 33 and a second guide roller 34, each of which co-acts, via a respective endless belt 20, 21, with
10 third and fourth guide rollers, reference 35 and 36, related to said second pivot axle 7, which is connected to fifth and sixth guide rollers 37, 38, and also related to said second pivot axle 7, wherein said fifth and sixth guide rollers co-act, via a respective endless belt 22, 23, with seventh and eighth guide
15 rollers, reference 39 and 40, co-acting with fourth and fifth gear wheels 31', 32', which are in engagement with a sixth gear wheel 30'.

20 It will be understood that the gear wheel arrangement is principally the same with same diameter and tooth pitch.

The pivot axle of the first gear wheel 30 extends parallel with the pivot axle of the sixth gear wheel
25 30'.

The fourth 36 and the fifth 37 guide roller are both positioned adjacent one another and are mutually connected so as to be rotationally rigid.

30 Each of the endless belts of the illustrated embodiment comprises lag-free movement transmissions, such as a toothed belt, and each of the guide rollers has a peripheral surface in which recesses corresponding to
35 the projections of the tooth belts are provided. This

feature is not shown for reasons of simplification. It will also be understood that other belt configurations can be used.

5 It is also proposed that first, second and third pivot axles 6, 7, 8 are positioned horizontally, whereas the fourth and fifth pivot axles 13, 14 are vertically positioned.

10 It also lies within the scope of the invention to drive the first gear wheel 30 and the axle 11 by means of a motor, referenced solely by the numeral 45 in Figure 2, in a known manner so as to provide a drive, via said
15 endless belt 20, 21, 22, 23, for transmission of rotary movement to the sixth gear wheel 30' and its axle 10.

The arrangement of pairs of endless belt 20, 21 and 22, 23 means that the forces will be counter-directional and will not influence the mutual position of the arms
20 3, 4.

In such cases, it is proposed that a cutting or grinding tool is attached to the axle 10 and the sixth gear wheel 30', in which embodiment the tool-attachment 5 is
25 omitted.

It shall also be noted that the guide rollers take a predetermined distance from one another via support arms, not shown in the Figure, or with the aid of the
30 outer casing, illustrated in Figure 1, for the first arm 3 and the second arm 4.

In accordance with the invention, the tool-attachment may have the form of a ball-fastener which can then
35 align the tool in a desired straight or oblique posi-

tion and lock the tool in one such position.

5 It is also possible to compensate for the intrinsic weight of the arms with the aid of springs. It is also possible to take measures which will enable lateral movement to take place with the same resistance as an arm-flexing movement.

10 It will be understood that the invention is not restricted to the aforescribed exemplifying embodiment and that modifications can be made within the scope of the inventive concept illustrated in the following Claims.

CLAIMS

1. An arrangement (1) for enabling a tool or the like
5 to be guided into different positions pertinent to a
first plane (A), said arrangement (1) including a
support (2), a first arm (3), a second arm (4) and a
tool-attachment (5) adapted to the tool, and in which
10 arrangement one end (3a) of the first arm (3) is pivo-
tally connected to the support (2) via a first pivot
axle (6), one end (4a) of said second arm (4) is pivo-
tally connected to the other end (3b) of said first arm
(3) via a second pivot axle (7), whereas the other end
15 (4b) of said second arm (4) is pivotally connected to
said tool-attachment (5) via a third pivot axle (8),
and in which arrangement endless belts or the like are
arranged to pass over guide rollers co-acting with
respective pivot axles in a manner such that when the
20 tool-attachment (5) is moved along a line (X) projected
from the arms (3, 4) onto the plane (A), said tool-
attachment will take one and the same orientation, and
in which the arm (3) is pivotally mounted relative to a
baseplate via a fourth pivot axle (13) which forms a
25 right angle with said first pivot axle (6), whereas the
tool-attachment (5) is arranged to rotate relative to a
fifth pivot axle (14) forming a right angle with said
third pivot axle (8) to a corresponding extent and in
an opposite direction, c h a r a c t e r i z e d in
30 that the fourth pivot axle (13) co-acts with a first
gear wheel (30) which, when the tool-attachment (5) is
displaced and rotated in a first direction (from B and
C), is operative to drive a second gear wheel (31) in
one direction and a third gear wheel (32) in an op-
posite direction in that the second (31) and third (32)
35 gear wheels each co-act with a respective guide roller

(33, 34), which co-acts via respective endless belt or the like (20, 21) with third (35) and fourth (36) guide rollers related to said second pivot axle (7), which is connected to fifth (37) and sixth (38) guide rollers and related to said second pivot axle (7); and in that said fifth (37) and sixth (38) guide rollers, via respective endless belts, or the like (22, 23) co-act with seventh (39) and eighth (40) guide rollers co-acting with fourth (31') and fifth (32') gear wheels which engage a sixth gear wheel (30').

2. An arrangement according to Claim 1, characterized in that the pivot axle of the first gear wheel (30) extends parallel with the pivot axle (14) of the sixth gear wheel (30').

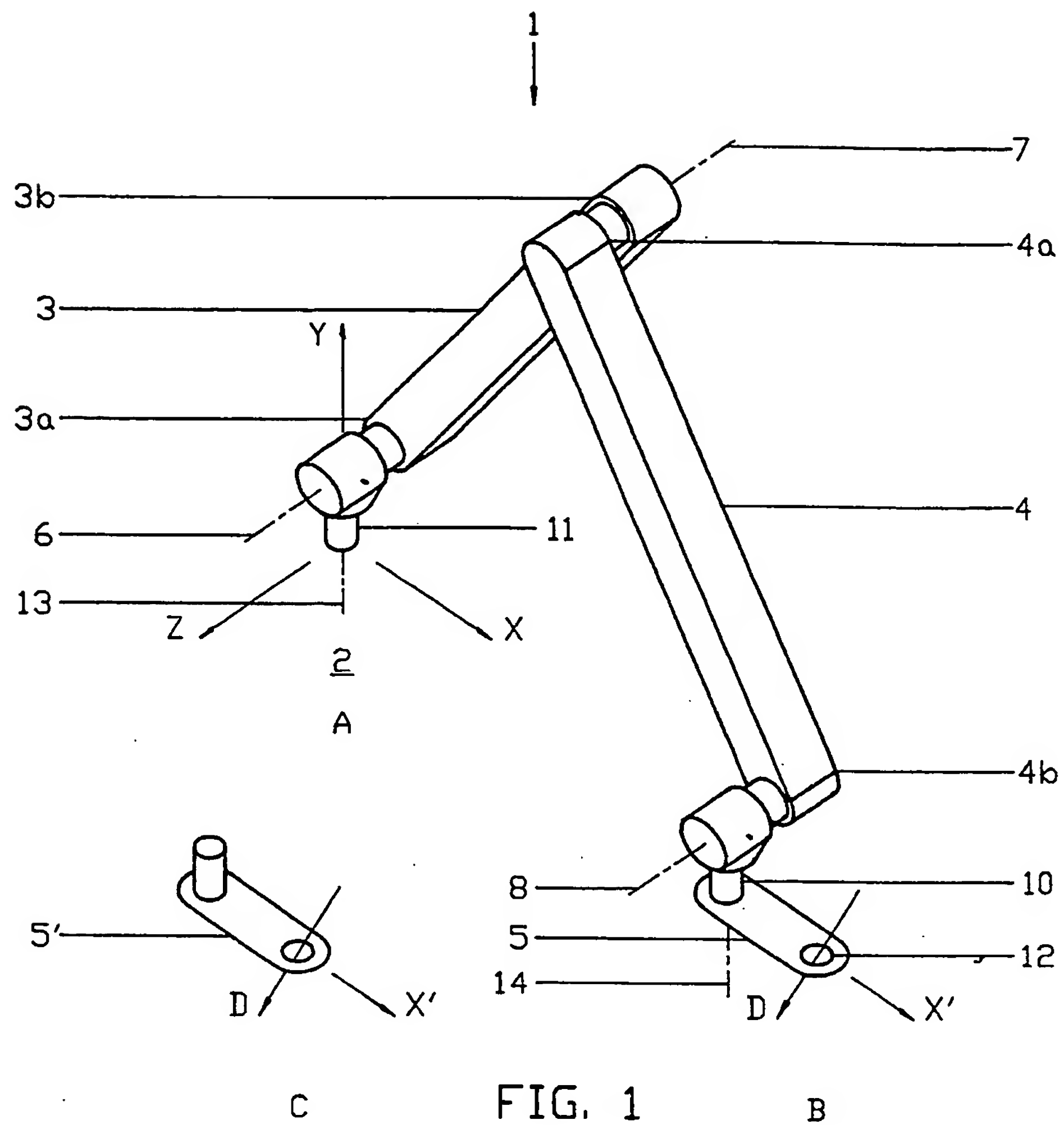
3. An arrangement according to Claim 1, characterized in that the fourth (36) and fifth (37) guide rollers are positioned adjacent one another and are connected together.

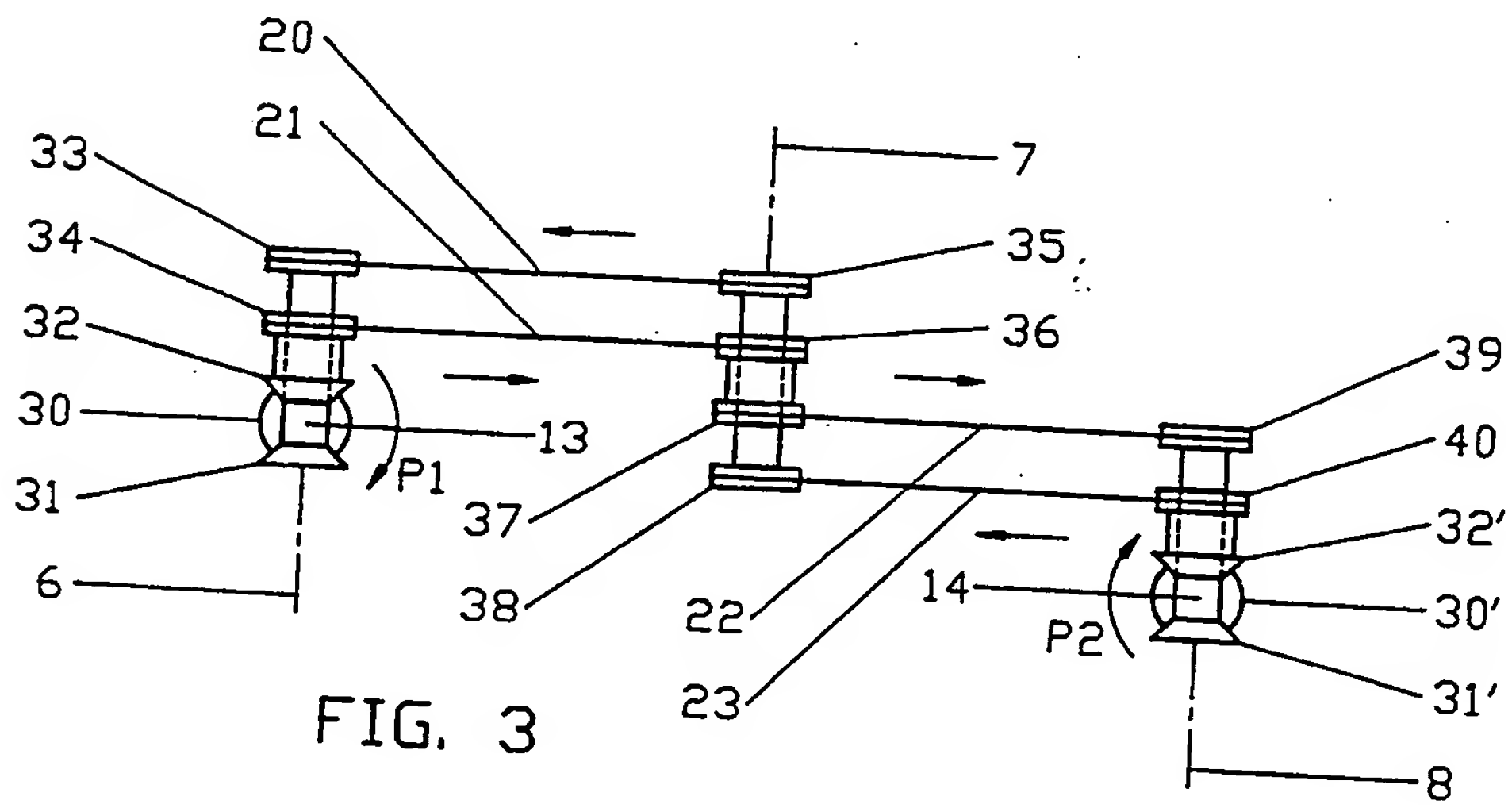
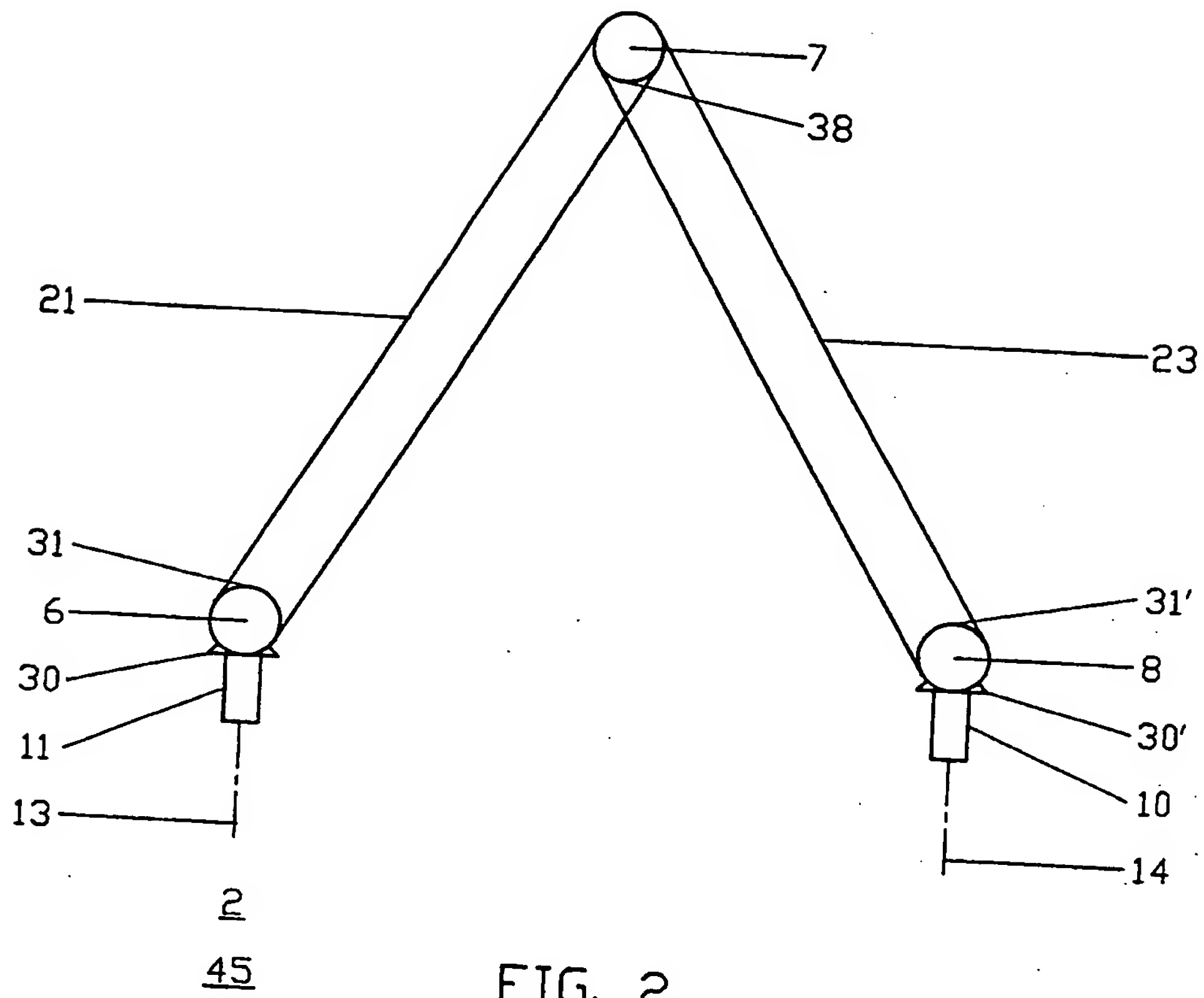
4. An arrangement according to Claim 1, characterized in that each of the endless belts (20, 21, 22, 23) comprises a toothed belt and each of the guide rollers has a peripheral surface provided with recesses which correspond to the configuration of the toothed belt.

5. An arrangement according to Claim 1, characterized in that the first (6), second (7) and third (8) pivot axles are parallel whereas the fourth (13) and fifth (14) pivot axles extend vertically and in parallel relationship.

6. An arrangement according to Claim 1, c h a r a c -
t e r i z e d in that the first gear wheel (30) is
driven by a motor (45); and in that said driving is
transmitted, via said endless belts, as a rotary move-
5 ment to the sixth gear wheel (30') and its axle (14).

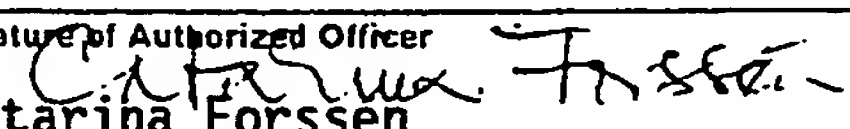
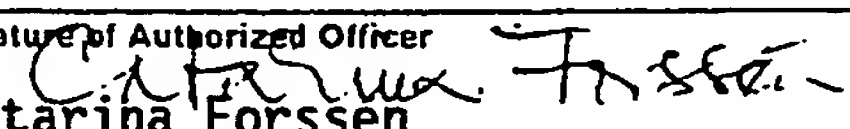
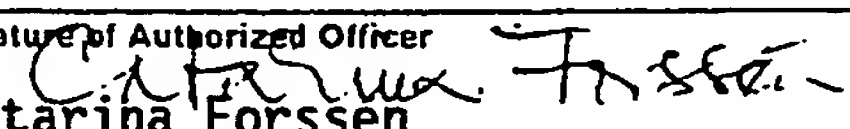
7. An arrangement according to Claim 6, c h a r a c -
t e r i z e d in that a cutting tool is attached to
said sixth gear wheel (30') and its axle.





INTERNATIONAL SEARCH REPORT

International Application No PCT/SE 90/00183

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC IPC5: B 25 J 9/10								
II. FIELDS SEARCHED <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Minimum Documentation Searched⁷</div> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; border-bottom: 1px solid black;">Classification System</td> <td style="border-bottom: 1px solid black;">Classification Symbols</td> </tr> <tr> <td style="height: 40px; vertical-align: bottom;">IPC5</td> <td style="height: 40px; vertical-align: bottom;">B 25 J</td> </tr> </table> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched⁸</div> <p style="padding: 5px;">SE,DK,FI,NO classes as above</p>			Classification System	Classification Symbols	IPC5	B 25 J		
Classification System	Classification Symbols							
IPC5	B 25 J							
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹ <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; border-bottom: 1px solid black;">Category *</th> <th style="width: 60%; border-bottom: 1px solid black;">Citation of Document,¹¹ with indication, where appropriate, of the relevant passages¹²</th> <th style="width: 30%; border-bottom: 1px solid black;">Relevant to Claim No.¹³</th> </tr> <tr> <td style="vertical-align: top; border-right: 1px solid black; height: 300px;">X</td> <td style="border-right: 1px solid black; padding: 5px;"> DE, A1, 3308474 (SCHLIMM, NORBERT) 13 September 1984, see figure 2 see page 9, first paragraph <div style="text-align: center;">-- -----</div> </td> <td style="vertical-align: top; padding: 5px;">1</td> </tr> </table>			Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	X	DE, A1, 3308474 (SCHLIMM, NORBERT) 13 September 1984, see figure 2 see page 9, first paragraph <div style="text-align: center;">-- -----</div>	1
Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³						
X	DE, A1, 3308474 (SCHLIMM, NORBERT) 13 September 1984, see figure 2 see page 9, first paragraph <div style="text-align: center;">-- -----</div>	1						
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>* Special categories of cited documents: ¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> </div> </div>								
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-A1- 3308474	84-09-13	NONE	

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